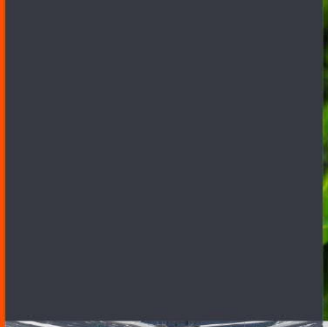
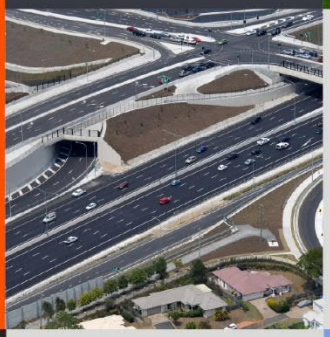
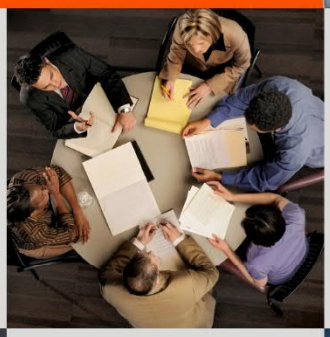
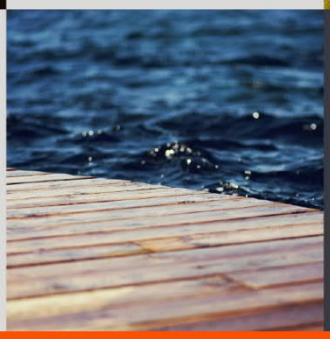






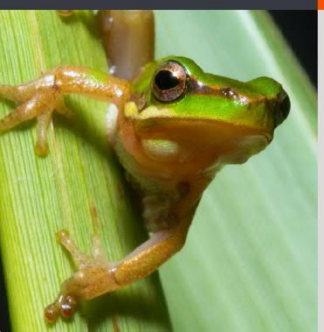
# DEVELOPMENT APPLICATION

## STORMWATER MANAGEMENT MASTER PLAN

Nightcap on Minjungbul | 2956 to 3224 Kyogle Road, Mount Burrell, NSW, 2484

Prepared for NCV Enterprises Pty Ltd
By Planit Consulting Pty Ltd

September 2020



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Project Details

| | |
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# 1 Introduction

## 1.1 Background

Planit Consulting Pty Ltd has been engaged by NCV Enterprises Pty Ltd to prepare a Stormwater Management Master Plan for the proposed multiple Rural Land Sharing Communities development (the development) at 2956 to 3224 Kyogle Road, Mount Burrell (the site). This report has been complied to support a development approval application to Council.

## 1.2 Scope

Given the large area of the site (1584.34ha), and the high-level nature of the application, this overarching Stormwater Management Master Plan (SMMP) has been prepared as part of the preliminary approval component of this application to inform the future development of the site. This will ensure an integrated/consistent stormwater management approach is applied to the development in its entirety.

The SMMP addresses the proposed stormwater management strategy including:

1. Stormwater Quality;
2. Stormwater Quantity;
3. Erosion and Sediment Control.

## 1.3 Limitations

The limitations of the report include:

1. Services locations are based on historical records,
2. No field sampling or testing has been undertaken,
3. No analysis or calculations as to the capacity of the existing services have been undertaken,
4. Preliminary geotechnical investigations have been undertaken,
5. Existing services location and size have been derived from Council and Statutory Authorities' search records which have been made available.
6. The concept plans provided are not for construction purpose.

This report has been prepared generally in accordance with Council guidelines and other reference documents.

# 2 Site Details and Surrounding Area Characteristics

## 2.1 Site Details Summary

Table 2.1 – Site Details Summary

| Project Information | | |
|---|---|---|
| Development Name | Nightcap on Minjungbul | |
| Applicant | NCV Enterprises Pty Ltd C/- Planit Consulting Pty Ltd<br>PO Box 1623<br>Kingscliff NSW 4218 | |
| Proposed Development Type | Concept Development Application for Multiple Rural Land Sharing Communities. | |
| Local Government Area | Tweed Shire Council | |
| Address | 2956 to 3224 Kyogle Road MOUNT BURRELL NSW 2484 | |
| Property Description | 1) 121 / DP134446<br>2) 3 / DP755714<br>3) 5 / DP582299<br>4) 4 / DP737440<br>5) 1 / DP390311<br>6) 35 / DP755714<br>7) 20 / DP755714<br>8) 33 / DP755714<br>9) 2 / DP611556<br>10) 34 / DP755714<br>11) 1 / DP611556 | 12) 2 / DP582300<br>13) 31 / DP755714<br>14) 32 / DP755714<br>15) 22 / DP755714<br>16) 19 / DP755714<br>17) 8 / DP755714<br>18) 11 / DP1194471<br>19) 2 / DP1148316<br>20) 1 / DP1183098<br>21) 2 / DP1235488 |
| Total Site Area | 1584.34ha combined area | |
| Zone | RU2 Rural Landscape (Tweed LEP 2014)<br>RU5 Rural Village (Tweed LEP 2014)<br>W1 Natural Waterways (Tweed LEP 2014) | |

## 2.2 Site Location and Description

The subject site comprises twenty (21) allotments generally located between 2956 and 3224 Kyogle Road, Mount Burrell. The site has a total area of approximately 1584ha, with the majority of it covered in bushland and plantations. The site currently provides a multitude of structures/facilities across multiple allotments including:

1. Several dwellings;
2. Camping grounds;
3. Rural shed structures;
4. Recreational structures (i.e. viewing platforms, sheds);
5. Farmland/Plantation areas;
6. Cabins; and
7. Approximately 50km of existing unsealed roads;

Refer to Figure 2.1 for the subject site location (the proposed development boundary is shown by the yellow outline) and Figure 2.2-2.5 for site photographs.

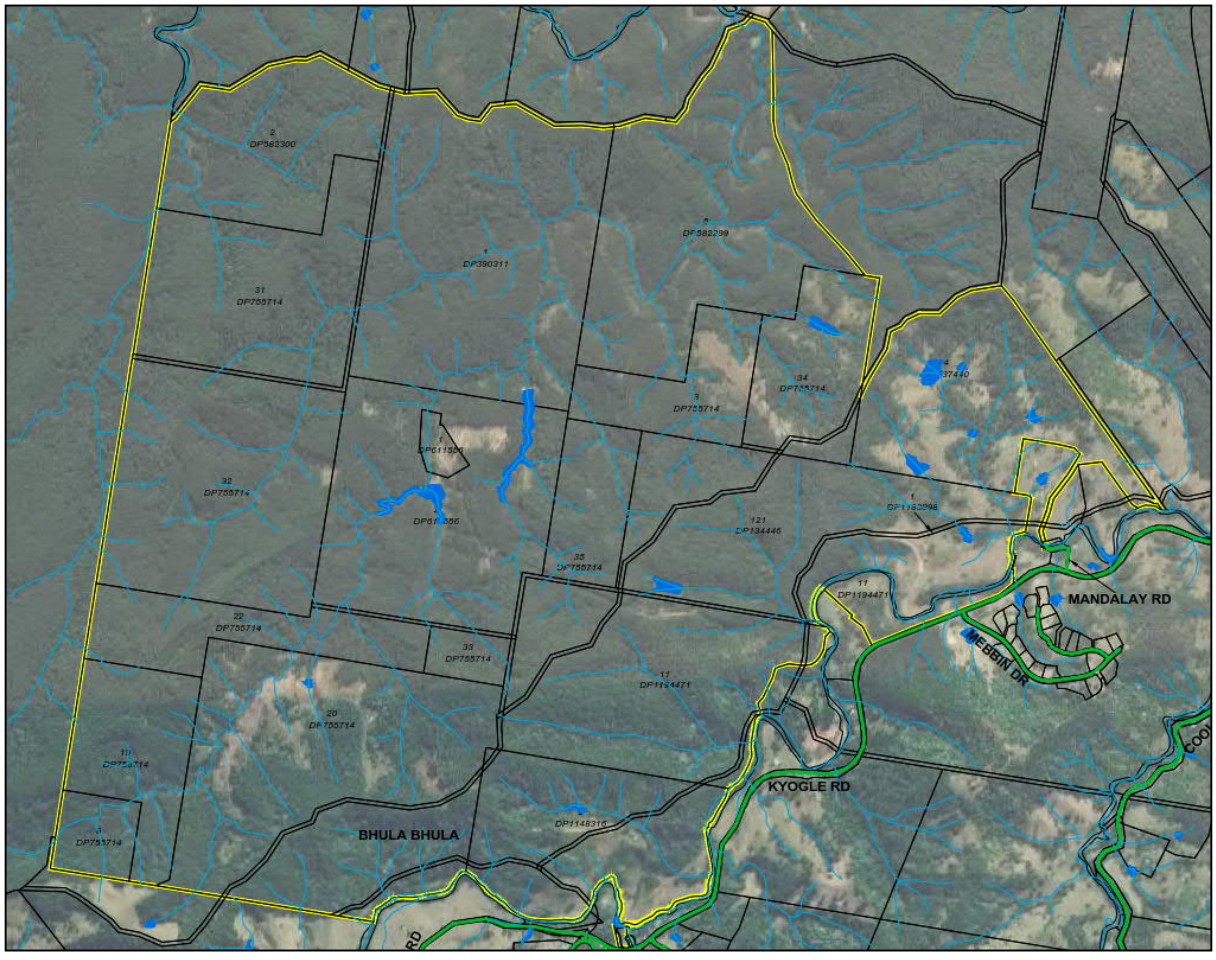


Figure 2.1 – Location of Subject Site

## 2.3 Site Photos

Figure 2.2 – Unsealed Road

Figure 2.3 – Unsealed Road

Figure 2.4 – Existing Rural Structure

Figure 2.5 – Existing Rural Structure

# 3 Proposed Development

It is proposed the 21 existing lots be split into 11 Lots. Table 3.1 below presents the existing and proposed lots.

Table 3.1 – Existing and Proposed Lots

| Existing Lots | | | | Proposed Lots | | | |
|---|---|---|---|---|---|---|---|
| Lot / DP | Area (ha) | SEPP Calc | Dwellings | Lot / DP | Area (ha) | SEPP Calc | Dwellings |
| 121 / DP134446 | 158.17 | 41.043 | 41 | Lot 1 | 44.34 | N/A Village | - |
| 3 / DP755714 | 37.939 | 10.985 | 10 | Lot 2 | 200.1 | 42.5 | 42 |
| 5 / DP582299 | 134.1 | 35.025 | 35 | Lot 3 | 260 | 62.3 | 62 |
| 4 / DP737440 | 90.82 | 24.205 | 24 | Lot 4 (Existing) | 90.82 | 24.205 | 24 |
| 1 / DP390311 | 162.27 | 42.068 | 42 | Lot 5 | 42.2 | 12.05 | 12 |
| 35 / DP755714 | 30.7561 | 9.1890 | 9 | Lot 6 | 210 | 54 | 54 |
| 20 / DP755714 | 177.25 | 45.813 | 45 | Lot 7 | 154 | 40 | 40 |
| 33 / DP755714 | 9.9047 | N/A | 0 | Lot 8 | 194 | 50 | 50 |
| 2 / DP611556 | 122.4 | 32.1 | 32 | Lot 9 | 210 | 54 | 54 |
| 34 / DP755714 | 47.04 | 13.26 | 13 | Lot 10 | 175 | 45.25 | 45 |
| 1 / DP611556 | 5.075 | N/A | 0 | Lot 11 | 40 | 11.5 | 9 |
| 2 / DP582300 | 71.71 | 19.428 | 19 | | | | |
| 31 / DP755714 | 89.031 | 23.758 | 23 | | | | |
| 32 / DP755714 | 125.453 | 32.863 | 32 | | | | |
| 22 / DP755714 | 46.5388 | 13.135 | 13 | | | | |
| 19 / DP755714 | 48.5623 | 13.641 | 13 | | | | |
| 8 / DP755714 | 16.187 | 5.547 | 5 | | | | |
| 11 / DP1194471 | 126.6 | 33.15 | 33 | | | | |
| 2 / DP1148316 | 81.51 | 21.878 | 21 | | | | |
| 1 / DP1183098 | 3.023 | N/A | 0 | | | | |
| 2 / DP1235488 | 0.04 | N/A | 0 | | | | |
| | | | | | | | |
| Total Lots | 21 | Area | 1584ha | Total Lots | 11 | Area | 1584ha |
| Dwellings achievable (excl. Village lot) | | | 410 | Dwellings achievable (excl. Village lot) | | | 392 |

The applicant is proposing a multiple occupancy development with 392 dwelling sites over the 11 lots and internal property access road network within the site. Refer to Figure 3.1 below.

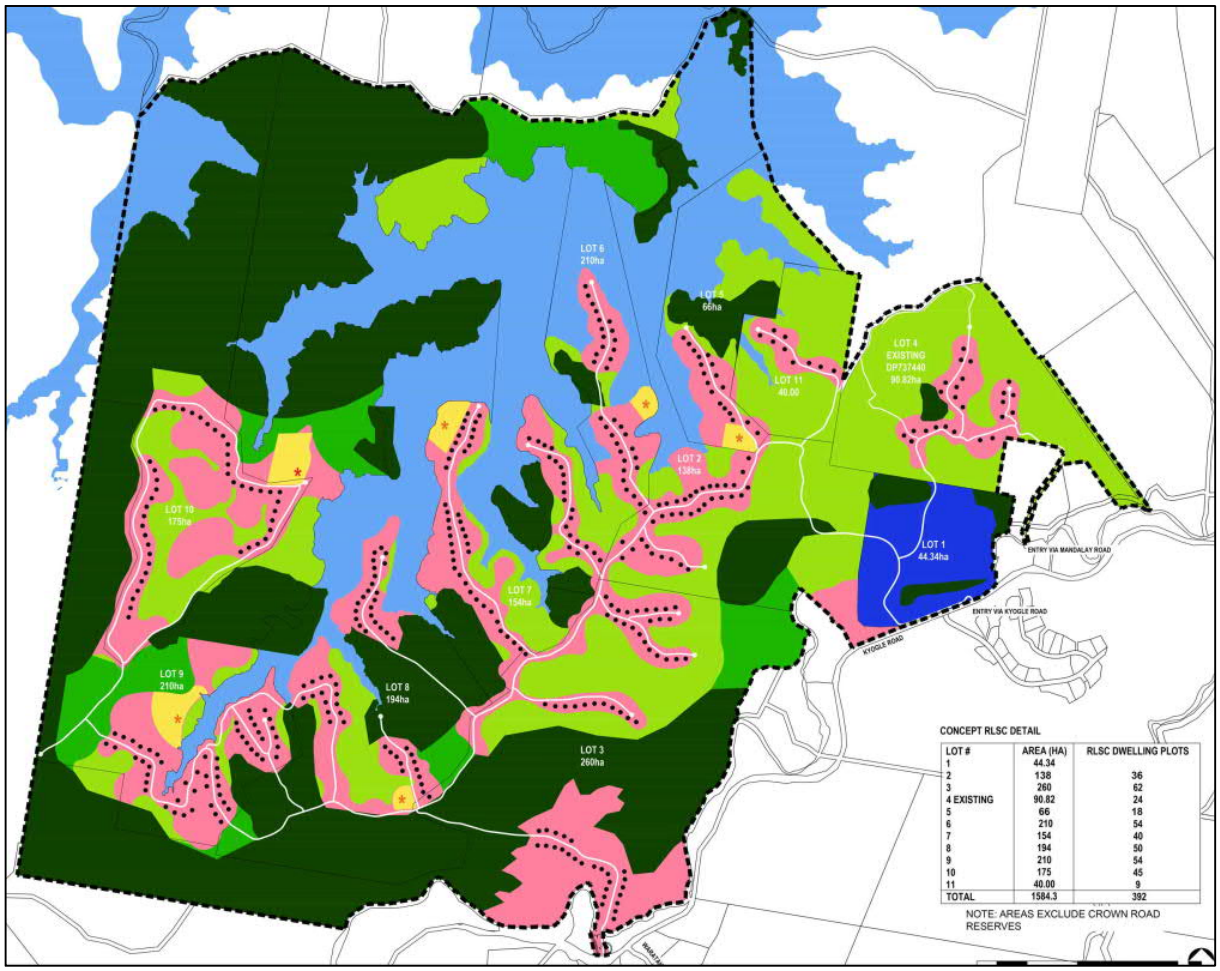


Figure 3.1 – Proposed Site

The location of dwellings and access roads are predominantly along ridgelines, however, there are vast areas of timber plantation that will be removed and management practices potentially available to reduce the overall bushfire hazard to the development.

The internal property access roads will have a main spine road which will allow alternate egress to differing intersection points of the existing public road system for the majority of the development.

Key stormwater considerations include:

1. There is approximately 50km of existing unsealed roads within the site.
2. Approximately 28km of the existing unsealed roads shall be widened from 2m to 6m to comply with RFS requirements.
3. Approximately 710m of the existing unsealed roads shall be sealed for grades greater than 17.6% (10 degrees) as per RFS requirements.
4. Assumed 50m Asset Protection Zone (APZ) shall be provided around every building.
5. 392 dwelling sites are proposed.

Due to the current high level nature of this proposal, there are no details regarding the layout, and locations of the proposed dwellings. This shall be confirmed at a later date during individual DA Applications.

# 4 Existing Topography and Drainage Patterns

As mentioned the site has a total area of approximately 1584ha, with the majority of it covered in bushland.

The overall development site ultimately drains to the Tweed River, however, the subject site comprises of multiple ridgelines draining stormwater in alternative directions. Accordingly, stormwater passing through the north of the site appears to discharge to Byrrill Creek and stormwater passing through the south of the site appears to drain directly to the Tweed River. Refer to Figure 4.1 for the existing catchments.

Topographic features include:

1. Max RL = 190m AHD approx.
2. Min RL = 100m AHD approx.
3. Maximum grade = 30% approx.

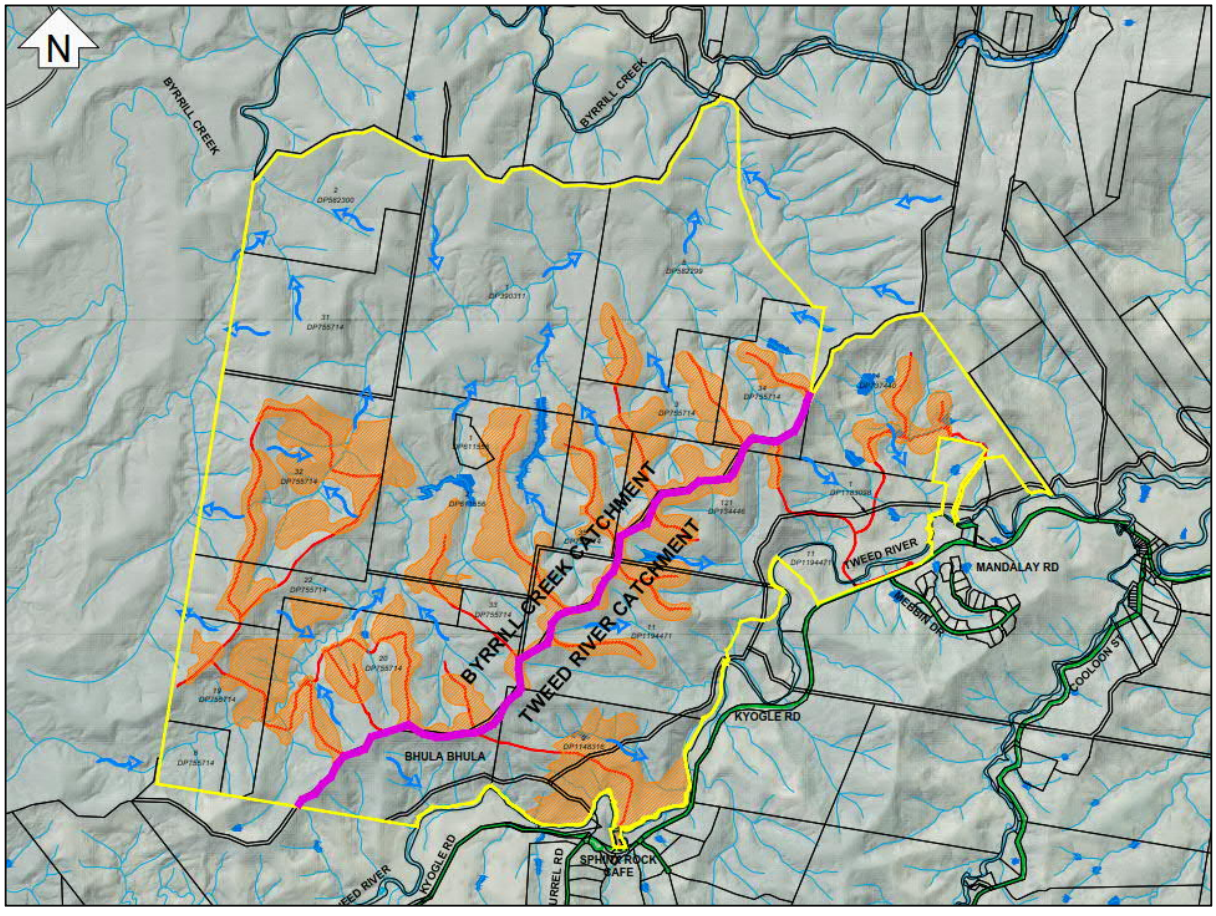


Figure 4.1 – Existing Catchments

## 4.1 Flooding Assessment

A search of Councils overlays indicates that the site is not subject to flooding.

## 4.2 Lawful Point of Discharge (LPD)

Considering the large scale of the proposed rural residential development, a LPD shall be defined in accordance with TSC specifications and QUDM.

TSC specifies a Lawful Point of Discharge as:

"Stormwater runoff and drainage may only be discharged from a development site at a "lawful point of discharge". This must be on or immediately adjacent to the development site and may be:

(a) A natural watercourse or waterway to which the development site naturally drains.

(b) A "lawful point of discharge" agreed to by Council (a kerb entry, pipe or open drain in a road, reserve or easement)."

Additionally, QUDM states:

"When changes to stormwater drainage within a site do not change the flow characteristics leaving the site, then the discharge will be lawful (assuming any previous circumstances and changes were lawful)."

Based on TSC's and QUDM definitions, it is proposed to implement stormwater mitigation measures individually on each dwelling to mimic stormwater flows produced from the pre development scenario. Therefore, runoff from each site shall not change the flow characteristics in the post development scenario and accordingly the LPD shall be considered just after the location of the implemented mitigation measure ensuring that flow characterisers of the pre and post development are consistent downstream. This strategy shall also be true for the construction of roadways.

Refer to Section 7 for the proposed mitigation measures.

## 4.3 Acid Sulfate Soils

Due to the high elevation of the site Acid Sulfate Soils are not expected to be encountered during excavations.

# 5 Stormwater Management Objectives

## 5.1 Proposed Development Affecting Stormwater Quality and Quantity

As previously mentioned the proposed works affecting stormwater quality and quantity are generally described below:

Existing Site (1584.34ha):

1. Bushland/Rural Catchment of 1584.34ha;

Proposed Development (57.4ha):

1. Proposed 393 dwellings;
    a. approx. 45.9ha of additional development area – allowing approximately 1,000m2 building envelope per dwelling
2. Additional 28km of road widening of unsealed road from 2m to 6m;
    a. 11.2ha of additional development area;
3. Additional 720m of road widening from 2m to 6m of sealed road;
    a. 0.3ha of additional development area;

Based on the above, the total area proposed to be developed is less than 4% of the existing site area.

The proposed development triggers objectives identified by Councils Development Design and Construction Specification. Objectives triggered are identified in Section 5.2 and 5.3 of this document.

## 5.2 Construction Phase –Erosion and Sediment Control

To address stormwater quantity and quality management during construction, controls must be implemented in accordance with Council's Development Design and Construction Specifications. Below is an extract from D7 Stormwater Quality – Construction Phase.

**CONSTRUCTION PHASE**

**D7.08 SOIL AND WATER MANAGEMENT ON CONSTRUCTION SITES - EROSION AND SEDIMENT CONTROL**

| | | |
|---|---|---|
| 1. | The construction phase includes the period from initial site disturbance until the time all construction is complete, all disturbed areas have been full revegetated and all permanent water quality control features have been installed and become occupational. The construction phase may overlap the occupational phase, particularly in staged developments. Stormwater quality works in the construction phase are focused on erosion and sediment control. | ***Construction phase,*** |

Figure 5.1 – Councils DCP - Erosion and Sediment Control Tigger

## 5.3 Operational Phase - Stormwater Quantity

### 5.3.1 Council Requirements

The below are Council's operation phase stormwater quantity control requirements for developments.

| | | |
|---|---|---|
| In pursuit of these objectives, the following principles shall apply: | | ***Design Principles*** |
| (a) | New Developments are to provide a stormwater drainage system in accordance with Section 7.03 of QUDM and the "major/minor" system concept set out in Chapter 14 of Australian Rainfall & Runoff, 1987 (ARR 1987); that is, the "major" system with an Average Recurrence Interval (ARI) of not less than 100 years shall provide safe, well-defined overland flow paths for rare and extreme storm runoff events while the "minor" system shall be capable of carrying and controlling flows from frequent runoff events. Notwithstanding, the recommendations of the above references "minor" drainage design for urban areas in the Tweed Valley shall provide for an ARI of not less than five (5) years. | |
| (b) | Redevelopment - Where the proposed development replaces an existing development, the on-site drainage system is to be designed in such a way that the estimated peak flow rate from the site for the design ARI of the receiving "minor" system is no greater than that which would be expected from the existing development. | |

Figure 5.2 - Councils DCP – Stormwater Quantity Requirements

### 5.3.2 Stormwater Quantity Proposed Compliance

In relation to the above the following is noted:

Major System:

1. Major/Minor System is not applicable for the proposed development due to its scale and no downstream developments are present;
2. The increase in peak flow for the proposed development shall be negligible, hence the existing well defined overland flow paths are considered suitable for rare and extreme stormwater runoff events;
3. There are no developed areas/catchment immediately downstream of the development and hence no risk to public health and safety;

Minor System:

1. It is considered that changes to the flow of minor systems within the catchments, due to the proposed development will be negligible.

Considering the above, no formal stormwater quantity treatment measures (i.e. detention) are proposed. The focus of the stormwater assessment will be sediment and erosion control for the proposed works during both the construction and operational phases.

## 5.4 Operational Phase – Stormwater Quality

It is noted that Council's DCP requires operational phase stormwater quality control measures for developments.

### 5.4.1 Requirements of Surrounding Council's

The following has been noted from a review of the DCP's / City Plans from surrounding Councils

City of Gold Coast City Plan:

Stormwater Management is not required for development in the Rural Zone.

**Table 4.8: Development triggers for stormwater quality management**

| Development type | Stormwater quality management triggers[1] | |
|---|---|---|
| | Erosion and sediment control (construction phase) | Stormwater quality management, waterway stability management, frequent flow management[4] |
| Material change of use and Preliminary approvals | All development involving preconstruction, construction or building works | (a) greater than 850m$^2$ of land<br>(b) 3 or more dwellings (attached or detached)[3]<br>(c) includes newly constructed road (previously unformed road) exceeding 30m in total length<br>(d) includes 200m$^2$ or more uncovered new or refurbished car park area including parking bays and circulation driveways |
| Reconfiguring a lot | All development involving preconstruction, construction or building works | (a) greater than 850m$^2$ of land and results in an increased number of allotments<br>(b) 3 or more allotments result in 3 or more dwellings (attached or detached)[3]<br>(c) includes newly constructed road (previously unformed road) exceeding 30m in total length<br>(d) includes 200m$^2$ or more uncovered new or refurbished car park area including parking bays and circulation driveways |

SC6.11 City Plan policy - Land development guidelines

City Plan Version 6 Page 52

CITY OF GOLDCOAST.

| | | |
|---|---|---|
| Operational works | All development involving preconstruction, construction or building works | (a) greater than 850m$^2$ of land and results in an creation of new allotments |

**Note:**

**(1) Stormwater management is not required for development in the Rural zone.**

**(2) Development which involves the material change of use of an existing building without any construction or building works does not trigger the requirement for stormwater management.**

**(3) For development in the Rural residential zone, where the 'residential' development results in less than 15% imperviousness (including roads and ground level impervious), then the stormwater quality objectives focus on road and parking areas only, with tanks and management of tank overflows required for buildings.**

Figure 5.3 – COGC City Plan - Stormwater Quality Development Trigger

Logan City Council:

Stormwater Management is not required for development where the development has less than 25% impervious area.

**3.6.1.4 Stormwater quality, frequent flow management and waterway stability infrastructure**

(1) Stormwater quality, waterway stability and frequent flow infrastructure is provided to achieve the stormwater management design objectives where the development site is a:

(a) material change of use for urban purposes where:

(i) the size of the premises is greater than 2,500m$^2$; or

(ii) it results in the creation of six or more additional dwellings; or

Sc6.2.5 Planning scheme policy 5—Infrastructure 3.6 Stormwater infrastructure standards
Logan Planning Scheme 2015 version 5.1 Sc6.2.5-79

(iii) located in the Loganholme local plan area; or

(iv) included in the Highway business precinct of the Specialised centre zone and located between the Pacific Highway and the southern boundary of the Loganholme local plan area; or

(b) reconfiguring a lot for urban purposes where:

(i) the size of the subject premises is greater than 2,500m$^2$ and results in an increased number of non-residential lots (e.g. industrial, commercial, etc); or

(ii) it results in the creation of six or more residential lots;

(iii) located in the Loganholme local plan area and results in a total of four or more lots; or

(iv) where included in the Highway business precinct of the Specialised centre zone and located between the Pacific Highway and the southern boundary of the Loganholme local plan area and results in a total of four or more lots.

(2) Section 3.6.1.4(1)(a) of this planning scheme policy does not apply where the development has less than 25 percent impervious area.

(3) Section 3.6.1.4(1) of this planning scheme policy does not apply where the development captures and manages the first 10mm of runoff per day from all impervious areas using:

(a) evaporation of stormwater; or

(b) reuse of stormwater (e.g. adequately sized rainwater tank with reuse facilities); or

(c) infiltration to native soils or filtration through an appropriately designed soil and plant stormwater treatment system.

(4) Section 3.6.1.4(1) of this planning scheme policy does not apply for waterway stability and frequent flow infrastructure where run-off from or within the site drains to a receiving waterway that is degraded.

(a) A waterway is degraded where:

(i) the proportion of impervious area within the catchment, prior to the proposed development, is greater than 30 percent and the waterway stability objective has not been applied to any existing development within the catchment, prior to the proposed development; or

(ii) the waterway is designed as 'highly disturbed' in Schedule 1 of the Queensland Environmental Protection (Water) Policy 2009.The stormwater management design objectives; or

(iii) as determined by the local government.

### 5.4.2 Initial Feedback from Council

Initial feedback from Council via phone is that Stormwater Quality Modelling is not considered necessary or appropriate for the proposed development. Council also advised that it is not a requirement to model roofwater for stormwater quality.

### 5.4.3 Stormwater Quality Proposed Compliance

Considering the above, no formal stormwater quality treatment measures are proposed. The focus of the stormwater assessment will be sediment and erosion control for the proposed works during both the construction and operational phases.

# 6 Road Drainage Considerations

This section discusses operational road drainage considerations on the proposed road formations, particularly in regards to ongoing erosion and sediment control. The unsealed sections of road and associated drainage infrastructure will require ongoing observation and maintenance.

As previously mentioned, approximately 28km of road will be upgraded/modified to comply with RFS requirements including:

1. Approximately 28km of existing unsealed road to be widened to 6m;
2. Approximately 710m of the existing unsealed roads shall be sealed for grades greater than 17.6% (10 degrees) as per RFS requirements;
3. 26.6% maximum grades proposed for short sections/lengths;

## 6.1 Road Alignment Considerations

The proposed road alignments have been largely governed by the location of the existing roads within the site. During detailed design, the following principles should be further considered in finalising the alignments of the new unsealed roads.

1. Reduce catchment areas above the road by locating the road along a ridge or as high as possible on side slopes;
2. Minimise the number of watercourse and drainage line crossings;
3. Avoid high erosion hazard soils (e.g. dispersive soils, soil loss classes 5, 6 and 7);
4. Avoid areas of riparian vegetation and maintain buffer strips between the road and any watercourse;
5. Avoid areas where there are perched water tables or areas of poor drainage;
6. Avoid areas prone to mass movement;
7. Avoid soil types having poor construction quality;
8. Minimise disturbance to soil and vegetation;
9. Longitudinal grade should be ideally less than 18%, however short lengths of steeper grades of up to 27% are acceptable.

## 6.2 Typical Road Sections

Planit have prepared a preliminary road design (incl. layout plans and longitudinal sections) of the proposed road works. The preliminary road design nominates a crowned road, however this may be adjusted during detailed design. From the preliminary design, three typical road section scenarios have been identified being:

1. Ridge Line
    a. Road sits on the ridgeline and can drain freely downhill either side of the road;
    b. No upstream catchment;
2. Cutting
    a. Road is cut into the ridgeline, however cannot drain freely downhill either side of the road. Road drains into roadside swales;
    b. No upstream catchment;
3. Cross Slope
    a. Road is cut into the side of a hill;
    b. Upstream catchment contributing;
    c. Road may drain into roadside swale;

Approximately 80% of the road shall have the ridgeline and cutting sections, the remaining 20% shall have a cross slope section.

Refer to Appendix 1 for civil engineering details.

## 6.3 Road Surface Drainage and Table Drains

Effective road surface drainage will be paramount in preventing/reducing runoff from concentrating and reaching erosive volumes or velocities. 'Erosion and sediment control on unsealed roads' prepared by The NSW Government Office of Environment and Heritage has been heavily used to inform the below recommendations.

The keys to the design of the roads (especially the unsealed roads) include:

1. Diverting upslope water away from the unsealed road and batters;
2. Ensuring any concentrated flows within the road corridor are below erosive levels;
3. Providing suitable drain and channel linings where flow velocities exceed erosive levels for the underlying soil material;
4. Selecting suitable batter grades and batter stabilisation treatments; and
5. Protecting drainage structure inlets and outlets with energy dissipaters and level spreaders.

### 6.3.1 Road Surface Water Flow and Spacing of Stormwater Drainage Outlet Structures

The below table details the maximum recommended distances of water flow along road surfaces and/or table drains running alongside the road. At each maximum distance, stormwater drainage outlet structures should be installed to discharge stormwater away from the road.

| Road grade (degrees) | Maximum distance (metres) | Road grade (degrees) | Maximum distance (metres) |
|---|---|---|---|
| 1 | 250 | 8 | 70 |
| 2 | 200 | 9 | 65 |
| 3 | 150 | 10 | 60 |
| 4 | 125 | 11 | 55 |
| 5 | 100 | 12 | 50 |
| 6 | 90 | 13 | 45 |
| 7 | 80 | 14 & 15 | 40 |

Figure 6.1 - Maximum Distances of Water Flow Along Road Surfaces or Table Drains
(Courtesy of NSW Government Office of Environment and Heritage)

### 6.3.2 Stormwater Drainage Outlet Structures

Stormwater drainage outlet structures shall be utilised to discharge stormwater away from the roads and swale drains at regular intervals.

Preferred Drainage Outlet Structures

The below drainage outlet structures are preferred as they are less likely to block and fail. These drainage outlet structures will not block easily and can direct high flows away from the road.

1. Catch drains on high side of cutting;
    a. Shall be utilised to prevent external catchment water flowing onto the roads and table drains;
2. Mitre Drains;
    a. Used to direct flow away and out of table drains before flows reach an erosive velocity/volume;
3. Rollover;
    a. Is a localised gentle lump constructed across a road that diverts the flow of water to the side of the road.

Less Preferred Drainage Outlet Structures

The below drainage outlet structures are less-preferred as they are more succeptable to failure through blocking.

4. Cross Drains (Inlet sump and relief culverts);
    a. Used to direct water flow in a table drain from the high side of a road to the low side by piping flow underneath the road;
5. Lined drop down drains;
    b. Used to transport water from road drainage structures (described above) down a fill batter to a safe discharge point without causing erosion;

Refer to Figure 6.2 for a schematic illustrating the drainage outlet structures.

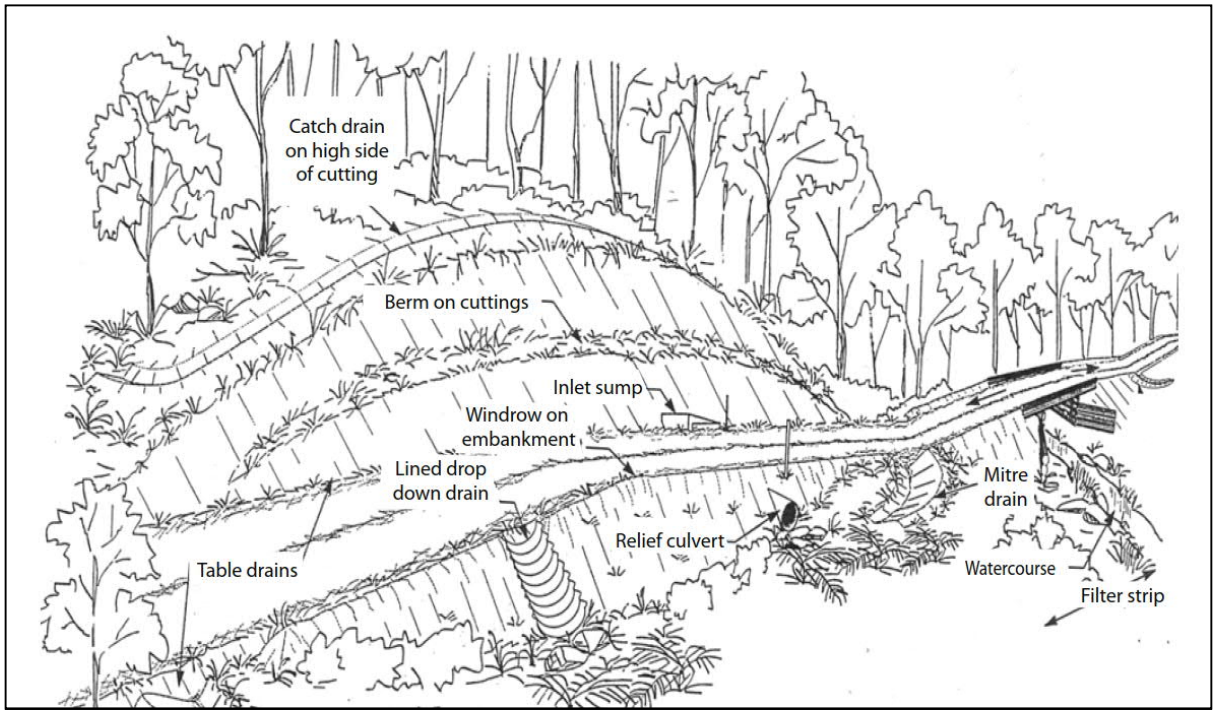


Figure 6.2 – Typcial Road Drainage Features
(Courtesy of NSW Government Office of Environment and Heritage)

## 6.4 Routine Maintenance

The following is recommended to ensure effective soil and water management on unsealed roads:

1. Conduct regular inspections to check that the road formation is performing adequately;
2. Ensure that drainage is working and the road and discharge areas are stable;
3. Inspect sediment and erosion control structures during and after heavy rainfall and minimise traffic where possible;
4. Maintain effective erosion and sediment control measures;
5. Ensure road usage is appropriate with road design;
6. Minimise the area of soil disturbed and exposed to erosion when conducting maintenance operations;
7. Stabilise and rehabilitate disturbed soil as soon as possible.

# 7 Stormwater Quality/Quantity Assessment

As mentioned in Section 5, Stormwater Quality/Quantity Modelling is not considered necessary or appropriate for the proposed development. As such, presented below are some best practice management methods that could be utilised.

The main consideration for this development is effective erosion and sediment control of the proposed unsealed roads. This element will be imperative during both the construction and operational phases.

## 7.1 Building Clusters – Best Practice Management

1. Aim to use source control to limit any changes to quality and quantity of stormwater;
2. Roofwater from proposed dwellings to be captured in rainwater tanks for reuse and potable water supply for dwellings;
3. Dwelling clusters shall generally be located on ridgelines at the top of catchments.
4. Aim to discharge overland flow as per the existing conditions/locations using swales, level spreaders, rock protection etc.;
5. Ensure appropriate scour protection is implemented to prevent erosion including grassed swales, appropriate scour protection at outlets.

## 7.2 Road Widening – Best Practice Management

1. Refer to Sections 8 and 6 for detailed discussion regarding this.

## 7.3 LPD

As mention in section 4.2 of this document, considering the large scale of the proposed rural residential development, a LPD shall be defined in accordance with TSC specifications and QUDM.

Based on TSC's and QUDM definitions, it is proposed to implement stormwater mitigation measures individually on each dwelling to mimic pre development stormwater flows. Therefore, runoff from each site shall not change the flow characteristics in the post development scenario and accordingly the LPD shall be considered just after the location of the implemented mitigation measure ensuring that flow characterisers of the pre and post development are consistent downstream. This strategy shall also be true for the construction and operation of proposed roadways.

Based on this strategy, the locations of the LPD will be determined during later DA stages ensuring flow characteristics at these locations during the post development scenario remain consistent with that of the pre development scenario for equivalent storm events.

# 8 Erosion and Sediment Control Assessment

For the proposed development, effective erosion and sediment control will be important during both the construction and operation phases of the proposed unsealed roads. This contrasts with sealed roads and many other forms of development where post-construction erosion and sediment control is a relatively minor issue.

## 8.1 Code of Practice for Soil and Water Management on Construction Sites

Unless otherwise directed by Council, all ESC plans prepared for the works must generally adopt and incorporate the Code of Practice for Soil and Water Management on Construction Sites contained in Annexure A of Development Design Specification D7, Soils and Construction – Managing Urban Stormwater Landcom 4th Edition 2004 and Soils and Construction – Volume 2C Unsealed Roads Department of Environment & Climate Change NSW.

## 8.2 Stormwater Objectives - Construction and Operation Phase

Council's DCP identifies stormwater objects during construction. For this project, these objectives will also apply to the operational phase due to the unsealed roads. The DCP's objectives include:

1. Minimise soil erosion and exposure;
2. Minimise transportation of eroded soil by air and water;
3. Limit/minimise the amount of site disturbance;
4. Isolate the works site by diverting clean upstream water around the development;
5. Control runoff and sediment at its point source rather than at final point;
6. Stage ground disturbance/earthworks progressively and revegetate the site where possible to reduce the area contributing sediment;
7. Retain topsoils for revegetation works;
8. Locate sediment control structures where they are most effective and efficient.

## 8.3 Preliminary Soil Characteristics

Douglas Partners have prepared a preliminary geotechnical investigation (Project 90579, March 2019). The report summarises the subsurface conditions generally as follows

1. 0.0-0.5m: Silty/clayey sand (medium dense or denser;
2. 0.5-1.0m: Clay (stiff or stronger;
3. Below 1.0m Completely weathered siltstone sandstone;

No free groundwater encountered during investigation.

Further investigation into soil erodibility will be performed during the detailed design phase to inform the proposed road designs and alignments.

# 9 Conclusion

This overarching Stormwater Management Master Plan (SMMP) has been prepared as part of the preliminary approval component of this application to inform the future development of the site. The report has determined the following:

1. The total area proposed to be developed is less than 4% of the existing site area;
2. Initial feedback from Council is that Stormwater Quality modelling is not considered necessary or appropriate for the proposed development;
3. Considering this no formal stormwater quality treatment measures are proposed;
4. Flows characteristics downstream of development works will be kept consistent with in both the pre and post development scenario through the implementation of energy dissipaters and level spreaders; and
5. The focus of the stormwater assessment will be sediment and erosion control for the proposed works during both the construction and operational phases.

# 10 References

1. Tweed Shire Council Planning Scheme
2. Managing Urban Stormwater – Soils and Construction – Volume 2C Unsealed Roads 2008
   Department of Environment and Climate Change NSW
3. Managing Urban Stormwater – Soils and Construction 4th Edition – Volume 1
   Landcom
4. Erosion and Sediment Control on Unsealed Roads 2012
   Department of Environment and Climate Change NSW

# Appendix 1 Preliminary Engineering Drawings

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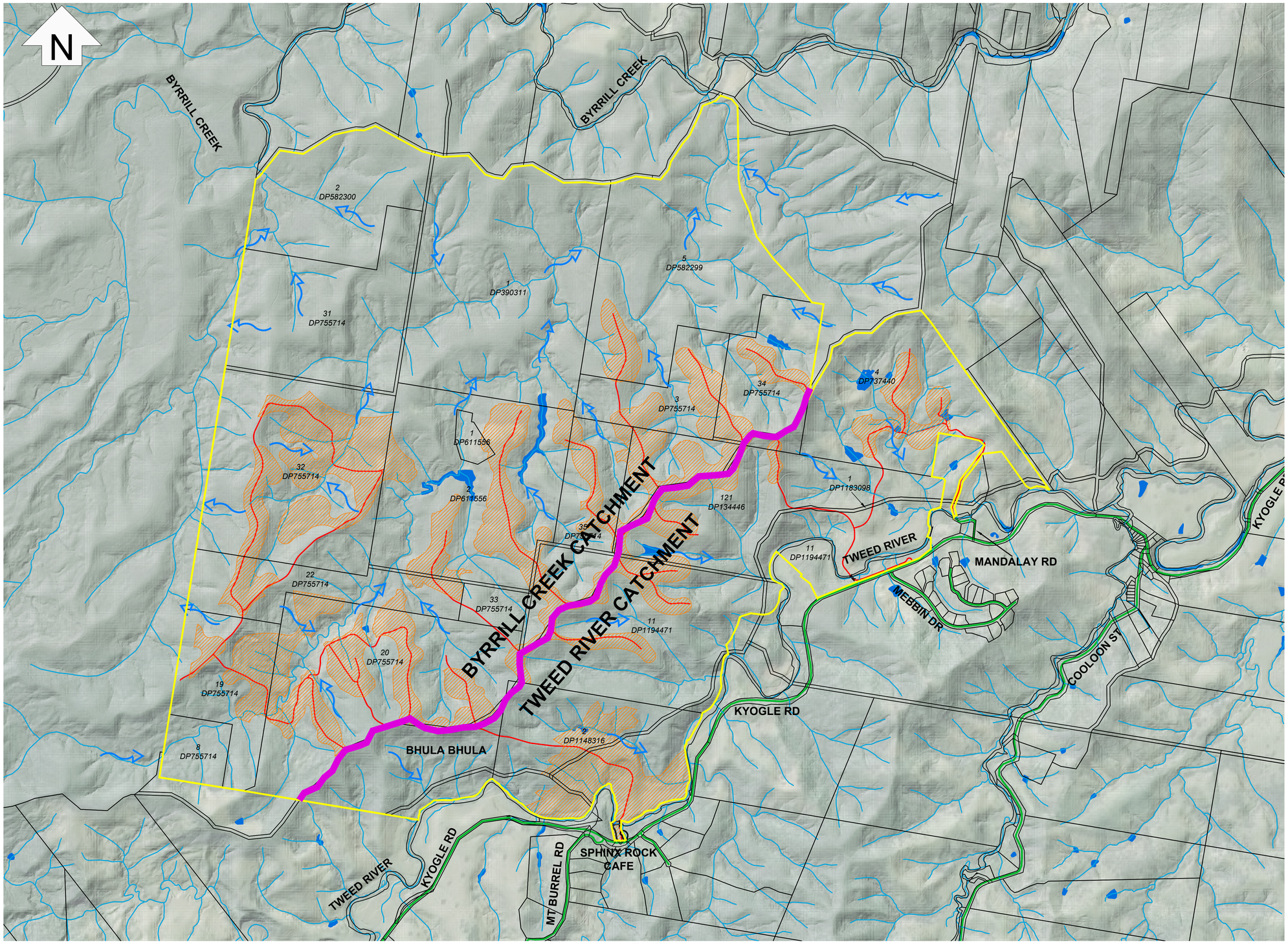


## LEGEND

- SITE BOUNDARY
- LOT BOUNDARY
- EXISTING PUBLIC ROAD
- PROPOSED PRIVATE ACCESS ROAD
- FUTURE DAM LAND ACQUISITION (RL 140)
- WATER COURSE (SOURCE: SIXMAPS)
- WATER BODY (SOURCE: SIXMAPS)
- PROPOSED BUILDING CLUSTER
- CATCHMENT SPLIT BOUNDARY
- OVERLAND FLOW PATH

## PLAN

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Scale (m)

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PROJECT: NIGHTCAP VILLAGE

DRAWING TITLE: STORMWATER CATCHMENTS

LOCAL GOVERNMENT AUTHORITY: TWEED SHIRE COUNCIL

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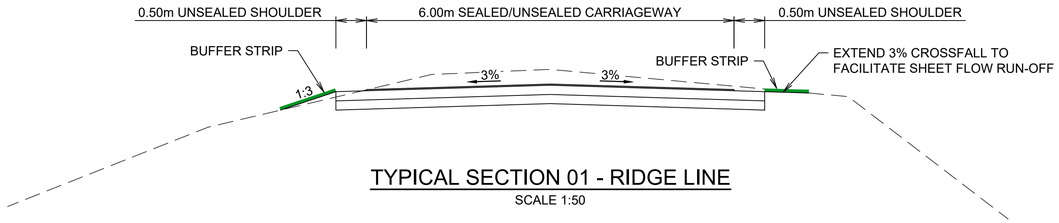


## TYPICAL SECTION 01 - RIDGE LINE

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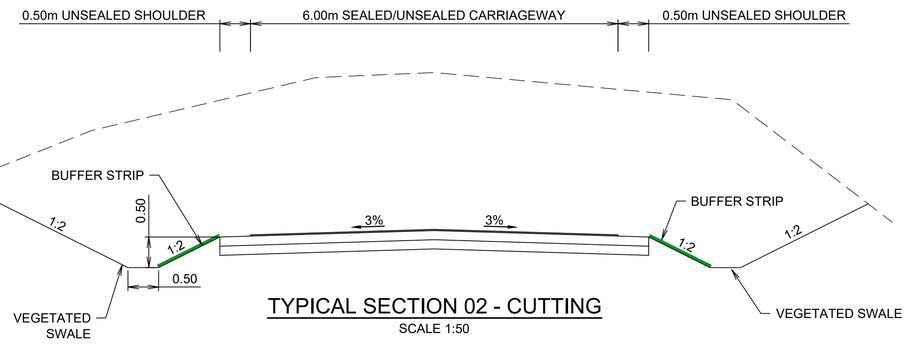


## TYPICAL SECTION 02 - CUTTING

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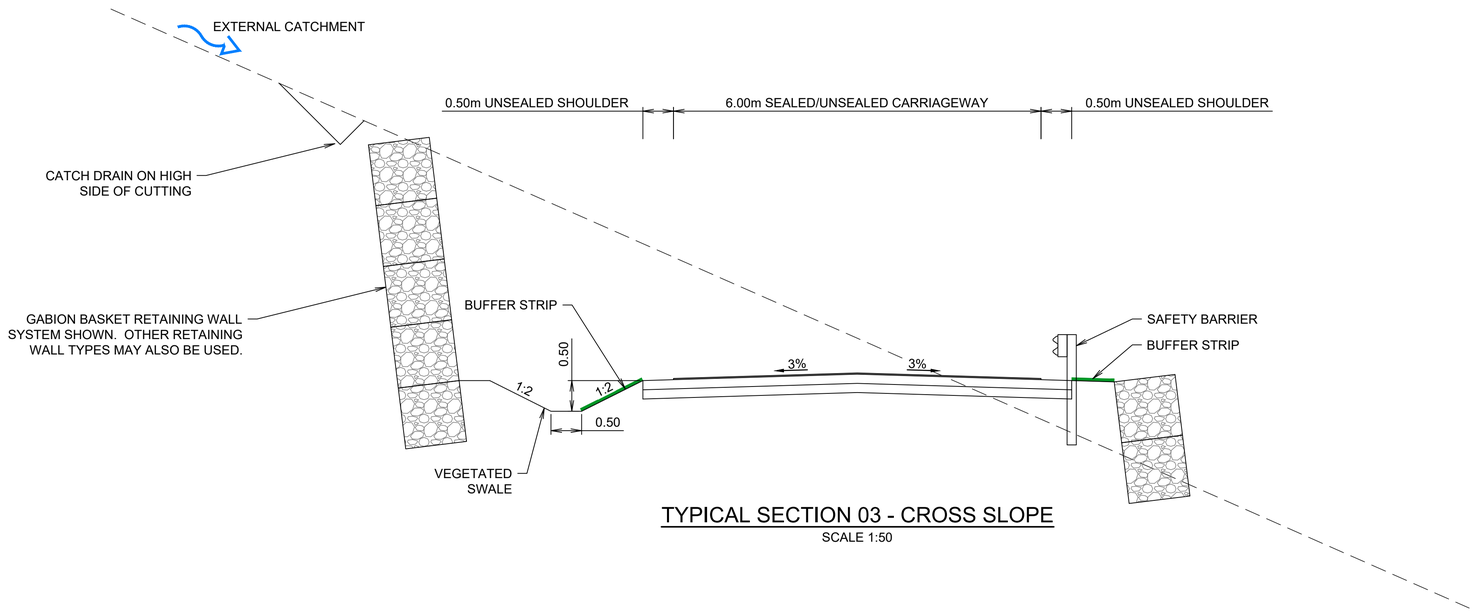


## TYPICAL SECTION 03 - CROSS SLOPE

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